Space Weather Technical Forecast

Issued on Wednesday, 01 February 2023 at 13:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant geomagnetic activity expected. Slight chance of M-class flares throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with several low-level C-class flares. There are six sunspot regions on the visible disc, all of which are small and magnetically simple. No Earth-directed CMEs have been identified on satellite imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1, was indicative of the waning influence of a coronal hole high speed stream. Speeds fell from 490 to 350 km/s. Density was around average. Total magnetic field, was weak and on a declining trend, varying between weakly positive and negative (+4/-6 nT). Phi angle was predominantly negative (towards the Sun) throughout. Geomagnetic activity was generally Quiet, with one Unsettled interval early in the period.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES16 has been at background levels throughout. High energy electron flux (greater than 2MeV) at GEO has been at mainly background to moderate levels. Electron fluence followed a declining trend, falling to 2.85e6 integrated pfu by 01/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low, with no significant sunspots on the visible disc and none due to rotate around from the farside. There is a very slight chance of M-class flaring based on the configurations of the visible regions.

Solar Wind / Geomagnetic Activity: A glancing CME may affect the Earth during 03 February, but with low confidence. The high speed stream from coronal hole 73 may connect during 02 February. Geomagnetic activity is expected to be mainly Quiet to Unsettled, with a slight chance of G1/Minor Storms on 02 and 03 February due to a coronal hole high speed stream and potential CME arrivals respectively.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES16 is expected to remain at background levels. Electron flux is expected to be at background or moderate levels. Electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold.

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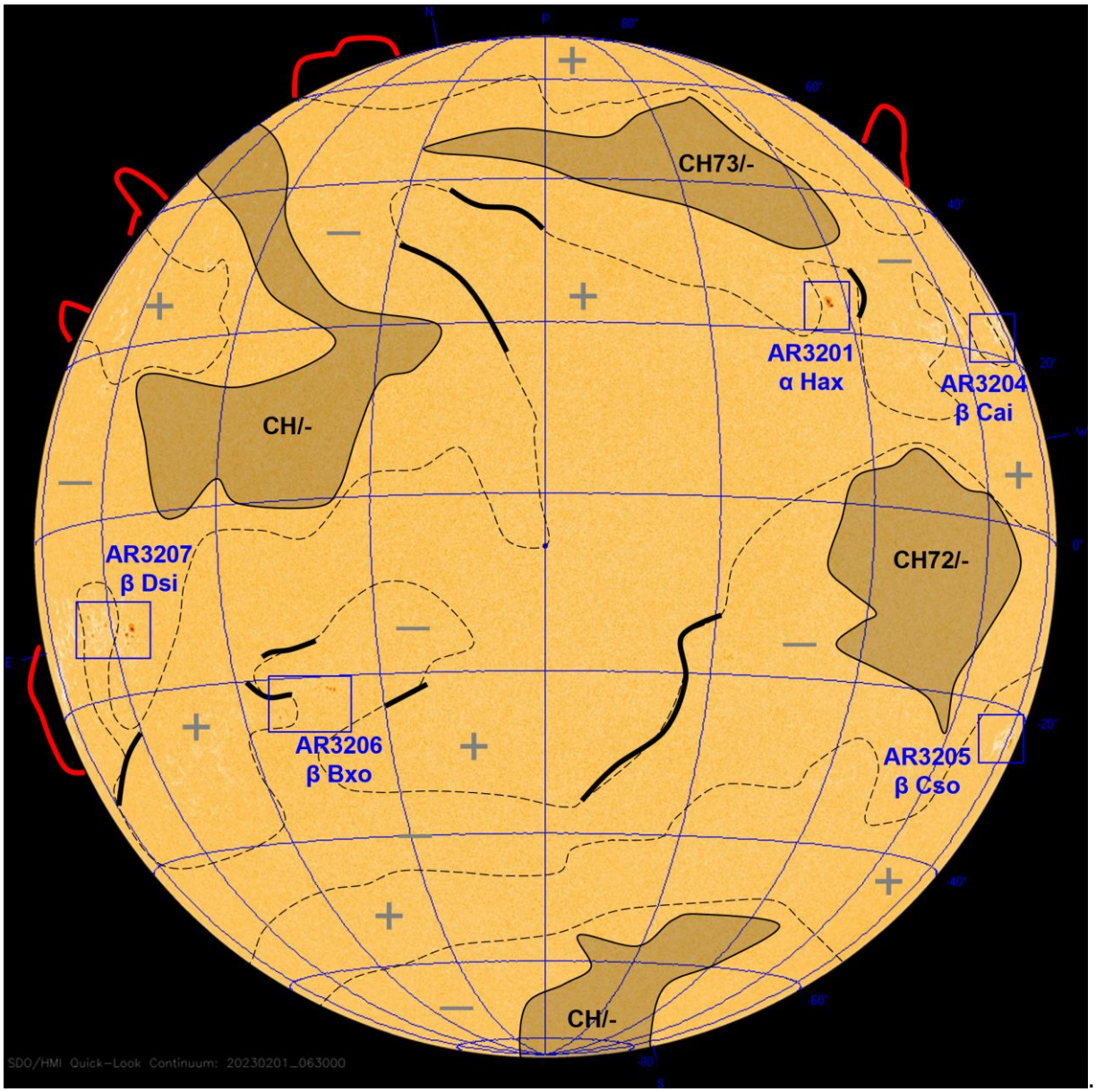
Figure 1. Solar Analysis Valid 01/0630 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There is the risk of a CME glancing the Earth, perhaps during 3rd Feb. This is from an eruption from the northwest quadrant on 30 January, although this is low confidence as the imagery used for modelling was difficult to interpret.

STEREO A data suggests a recent connection to a weak coronal hole fast wind, perhaps from CH73/-. Earth may see a similar connection sometime on 2nd Feb, as STEREO A is one day ahead of Earth.

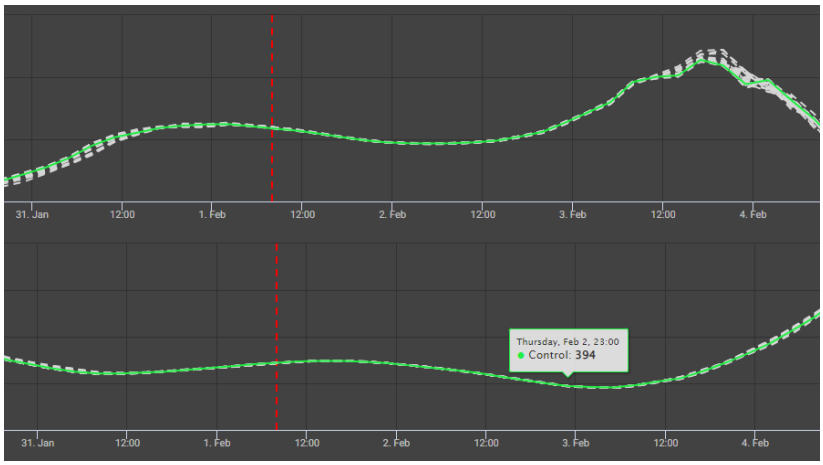
Geomagnetic activity is expected to be mainly Quiet to Unsettled, with a chance of Active intervals and a slight chance of G1/Minor Storms both 2nd and 3rd Feb, due to a coronal hole high speed stream and a CME glancing blow.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	10	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
31/0416	Partial	Unknown/filament	NW	350	3rd	Glancing blow possible

Figure 2:ENLIL Ensemble indicating CME arrival on 3rd.



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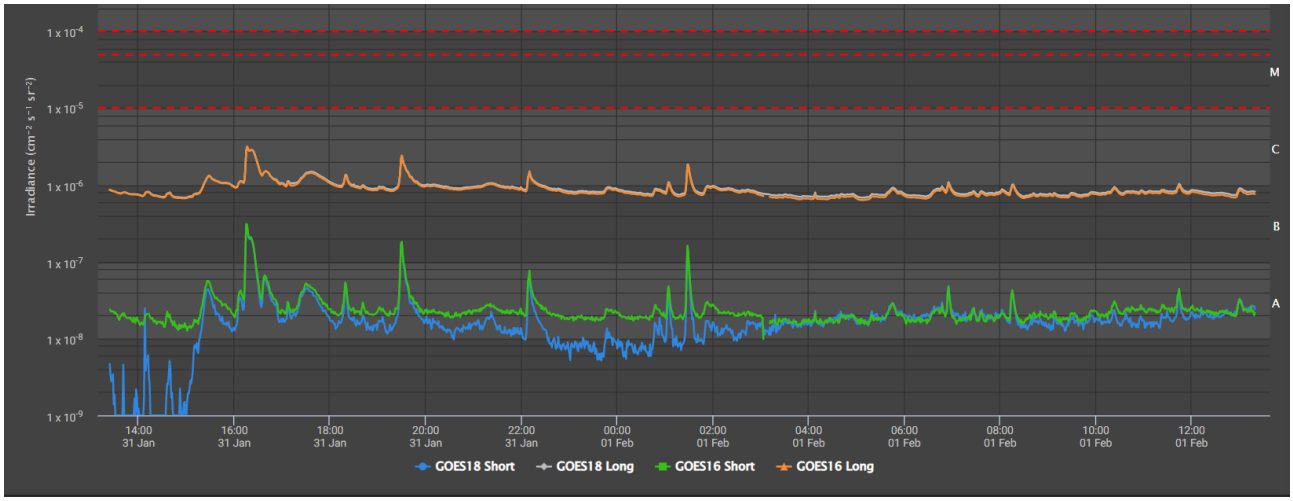
Radio Blackouts - X-Ray Flares:

There are five sunspot regions on the visible disc, with all of these relatively inactive. Helioseismology reveals the potential for a number of previously active regions to rotate across the eastern limb through the next four days, However there has not been evidence of much activity from the farside and therefore do not affect the probabilities.

Mainly Low solar activity is expected, with a slight chance of M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-Ray flare trace over past 24 hours.



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Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux as observed by GOES16 is currently expected to persist at background levels. None of the sunspots in or due to rotate into the western hemisphere carry a significant proton storm risk.

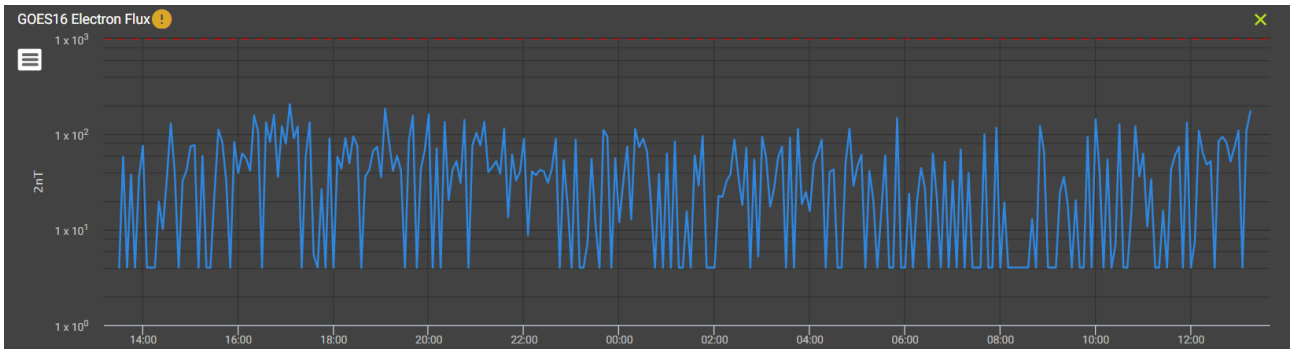
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) is at background levels, and is expected to oscillate between moderate and background levels through the next four days. Potential geomagnetic activity on 02 and 03 February may act to suppress this further. Electron fluence is at low levels with any rise over the next four days expected to be modest. The Active (1e8 integrated pfu) threshold is not expected to be reached.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: Electron flux trace past 24 hours.



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